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## *THE GROUP AS A STIMULUS TO MENTAL ACTIVITY*[1]

THE purpose of this paper is not to present the results of an original investigation, but merely to suggest a problem. Efficiency in brain activity and in correlated mental activity depends upon many conditions. Among these are physiological age, race, sex, the blood supply to the brain, as determined by general nutrition, exercise, posture, and the size of the cerebral arteries; the quality of the blood as determined by food, drugs, the supply of oxygen, nasal respiration, etc.; again by a group of conditions which make up the environment, the temperature, humidity, barometric pressure, light, peripheral stimulation, etc. Again as the social instincts in man are fundamental, one of the most important factors in his environment is the presence or absence of other human beings. This can not be ignored. The problem I wish to present is this: What is the effect on mental activity of the presence of a group of other persons, if studied objectively like the effects of temperature, barometric pressure, or the like? Perhaps the best way to present this problem is to recount briefly the meager but important results of investigations already made.[2]

Studies in social psychology have shown that an individual alone and the same individual in a group are two different psychological beings. Recent investigations show that the same is true of children. The

[1] Read before Section L, American Association for the Advancement of Science, Boston, December, 1909.

[2] For reference to the studies mentioned below see *Ped. Sem.*, Vol. XII., June, 1905, pp. 229–230.

child working alone is different from the child working in a class. A few years ago Dr. Mayer, of Würzburg, studied experimentally this difference as regards the ability to do school work. His problem was to determine whether and under what conditions the work of pupils in a group give better results than the individual work of the isolated pupil. He tested the ability of pupils to work alone or in company with others, using dictation, mental arithmetic, memory tests, combination tests after the manner of Ebbinghaus, and written arithmetic.

Dr. Mayer's method was briefly as follows: a number of boys in the fifth school year of the people's school in Würzburg were given five different tasks as class exercises, and also each boy was required to prepare a similar task for comparison in which he sat alone in the class-room, only the class teacher or a colleague being present. The material for the tasks was carefully chosen and was familiar to the pupils. The pupils were representative of very different elements as regards school ability, behavior, temperament, and home conditions. The number tested was 28, the average age twelve years.

In general the result of the work of the pupils in groups was superior to their work as individuals. This appeared not only in the decrease of time, but in the superior quality of the work done. In individual cases the saving of time was specially striking; for example, one pupil for a combination test required 10 minutes and 25 seconds when working alone, for a similar test when working with the group 7 minutes and 30 seconds; another, alone 13 minutes and 11 seconds, with the group 6 minutes and 45 seconds.

Dr. Triplett tested the influence of the presence of a coworker on a simple physical performance. His subjects were forty school children, and he had them turn a reel as rapidly as possible. The children turned the reel now alone and then in company with another child, in both cases with directions to turn as rapidly as possible. Two results were noted. It appeared, on the one hand, that pupils worked more rapidly when another child worked in combination; but, on the other hand, in case of many children, hasty uncoordinated movements appeared which reduced their performance.

Wherever men are together the individual is influenced by others without being aware of it. This is specially well illustrated by certain experiments in the laboratory. Meumann cites the case of a subject whose work at night with the ergograph had a very definite value. Accidentally one evening Meumann entered the laboratory, and at once the work done was decidedly increased in comparison with that of other days, and this without the subject's making any voluntary effort to accomplish more. In such experiments the subject always attempts to do his utmost, and hence the significance of the increased work done in the presence of another individual. Many examples of such effects of suggestion have been reported by psychologists.

Meumann, in experiments in the People's Schools, corroborated the results of Triplett and Féré in a striking manner. Seven pupils of the age of thirteen or fourteen were tested repeatedly with the dynamometer and ergograph. In case of the test of the pupils separately, with no one else in the room, the amount of work was always less than when others were present. If the experiments were made in the presence of the teacher alone, the pupils did not do as much work as when they were all together without the teacher.

From all this it appears, as Mayer points

out, that pupils in a class are in a sort of mental *rapport;* they hear, see and know continually what the others are doing, and thus real class work is not a mere case of individuals working together and their performance the summation of the work of many individuals; but there is a sort of class spirit, so that in the full sense of the word one can speak of a group performance, which may be compared with an individual performance. The pupils are members of a community of workers. The individual working by himself is a different person. Schmidt in his careful investigation testing school children in their home work as compared with their school work found that for most kinds of work the product in the class-room was superior. His results are to a considerable degree evidence in corroboration of the results found by Mayer. The child studying school tasks at home is relatively isolated; in the class he is one of a social group with common aims.

A noteworthy result of these investigations is the apparent immunity of children to distraction from ordinary causes. Schmidt found that the outside disturbances—the noise from the street, from adjoining rooms, and the like, had little effect upon them. It was only interruptions that distracted their attention, such as conversation with others, that affected the quality of their work. It appeared even that a home task completed without disturbance might be poorer than the corresponding class work, and that a home task when the pupil was disturbed might be better than the class work. And from Mayer's study it appeared that the tendency to distraction is diminished rather than increased by class work.

Meumann in tests of the memory of pupils alone and when working together found similar results. Disconnected words of two syllables were used, which were written down, pronounced once to the pupils and then written down immediately by them from memory. It would naturally be supposed that the children working in the class-room, with all the inevitable noises and disturbances, would not remember as well as when tested alone. The result of Meumann's investigation, however, was surprising. While in case of children thirteen and fourteen years of age there was no essential difference in memory for the individual and the common test, the difference was remarkably large in case of the younger children, especially in case of those eight and nine years of age. On an average with the individual test the children remembered considerably less than in the class. The results were constant. Not a child was found who remembered more in the individual test than in the class test. From this Meumann concludes that the great number of disturbing influences to which children are inevitably exposed in the classroom—the noise of writing, whispering, walking about, the occasional words of the teacher, the sight of the movements of the pupils, and the like, which one might naturally suppose would make the results inferior, have no special influence.

Meumann asked a number of the pupils in case of the individual tests whether they would prefer to take such exercise in the class or alone, whether they were disturbed by the noise of the other pupils. To his surprise 80 per cent. of the pupils gave the decided answer that they would prefer to do the work in the class. Some 15 per cent. gave no definite answer. The others, an extremely small minority, replied that they were disturbed in the class-room; and in most cases these were sensitive, nervous or weak children, although among them were some individuals of decided talent.

Thus it appears that the presence of a

group distinctly affects the mental activity. Of course the easy explanation of the increased ability to work often found in the group is to say that it is due to ambition. rivalry and the like. This is all true enough, but we can analyze this a little further.

A few things are pretty obvious. First of all, where activity is involved, there is the stimulus to greater exertion which comes from the sight of another performing an act. As Professor James has said, the sight of action in another is the greatest stimulus to action by ourselves. This has manifold illustrations from the activities of primitive man to modern experiments in the laboratory. In early stages, for example, an institution sometimes found is the *præsul*. A leader stands before a group who are engaged in work or a dance and himself performs perhaps in pantomine the activities which they are attempting. This stimulates and renders easier the activity of the group. Every paced race on the athletic field also furnishes an excellent illustration. Again in the laboratory, Féré found that the amount of work one could do with the ergograph was increased by having another person simply go through the action of contracting the muscles of the finger in sight of the subject of the experiment, the second person acting as a sort of pace-maker for the first. The clearer and more intense the idea of an action the more efficient the action.

There is undoubtedly also an affective stimulus in the presence of the group. This is the stimulus which comes from our social impulses as inherited from the past, and yet it should be noticed that such affective stimuli, which, I take it, are what is really meant by ambition and the like, may act either to increase or to inhibit the mental activity. A certain degree of affective stimulus undoubtedly increases the ability to work, but if the stimulus is extreme the work is checked or inhibited altogether. For example, extreme anger, stage fright and even extreme joy, in the presence of the group, may inhibit the mental activity.

In many individuals at least the presence of the group is a stimulus to greater concentration of attention. In case others are doing the same thing, this helps us attend better to the activity in hand; and even in case others are doing something different, the distraction itself is sometimes a stimulus to better attention, because the individual tries to resist the distraction and there is an over-compensation which improves the attention. Meumann, for example, has found this result in certain experiments.

Meumann emphasizes particularly this compensation power of attention. Not merely is it true that the performance of an individual often increases when there are disturbing stimuli, because the increased concentration to overcome the distractions increases the work; but more than this, the compensation, which in this case becomes an over-compensation, shows that the disturbing stimulus has the effect of increasing rather than decreasing the energy, that is, it has a dynamogenic effect, although this effort does not occur in case of all individuals.

The measure of this is of course the increase of the performance by the distracting stimulus. This is very well shown with the distraction stimulus when one is committing to memory. By Meumann's method the memory span or the number of figures or letters that can be remembered without error after once hearing is determined, and then disturbing stimuli are introduced. An acoustic stimulus may be introduced for distraction, *e. g.*, a metro-

nome strikes. Such a distraction often improves the performance.

To describe the stimulus to the imagination from the group would be commonplace. We need not go to the laboratory nor cite the case of children for illustration. The man in the crowd has always been able to see what has happened and more besides, to foresee impending danger, or anticipate success, or hear voices from the unknown and behold inspiring visions. We need not, I think, go back to ancient history for illustrations of even the latter. A week ago in my home city thousands of people watched for mysterious lights in the heavens, and not a few saw them and knew exactly what they meant. Nor was this the only place where men saw the moving lights of airships. Even of the groups on Boston Common it was reported that the clear rays of a moon approaching the full failed to undeceive "those who, having seen, believed, or believing that they had seen refused to doubt, or not having seen, had met and talked with those who had seen, or believed they had seen or had met those who had seen."

As regards the relative merits of solitude or a social environment for scholastic pursuits I am not concerned here to speak. But the weight of evidence thus far seems to be to indicate the advantage of group work, except when individual and original thinking is required. This is perhaps one reason why the man of genius has frequently desired solitude. There are undoubtedly, also, great individual differences as regards the effect of social environment; there are even perhaps different types as regards the effectiveness of the stimuli from the social group. There may perhaps be one type that does its best work in solitude, another type that does its best work in the group. This again is one of the problems that should be investigated.

Again, of course, the question is relative to the kind of work done. Mayer's experiments indicate that for some kinds of work the stimulus of the social group is needed. For some kinds of work, especially where original thinking is demanded, the environment of solitude is better.

What we may call the social stimulus to mental activity is such a commonplace matter that probably very few realize its significance. When, however, we recall the fundamental character of our social instincts it is not strange that the presence of other people should be a most potent stimulus either increasing or checking the mental activity. Psychologists have always recognized the fundamental character of the stimulus from ambition, rivalry and the like. But this social stimulus goes much farther back and is rooted in the reflexes of the sympathetic nervous system that are correlated with emotion. This is well illustrated in experiments with animals. Mosso found in his experiments testing directly the sympathetic reflexes in the dog that the presence of the master in the room at once affected the reflexes; and Dr. Yerkes, of Harvard University, finds that in his experiments with dogs the presence of the experimenter is always likely to affect the results.

The fundamental character of the social stimulus is shown also in many fields of human activity according to one view of esthetics. The artist always works with the audience in his mind. The teacher also and the orator are apt to do much of their work with the class or audience in mind. I am not concerned here with the fact that this often becomes a grotesque and exaggerated mark of the profession but merely with this as an illustration of the fundamental character of what we have called the social stimulus.

In fact this social stimulus colors every-

thing. It is compa[illegible] only to the constant peripheral sti[illegible]tion which is necessary to keep us a[illegible]; in like manner a social stimulus is nec[illegible]ary as an internal condition, as we may say, of consciousness.

Perhaps the fundamental character of this social stimulus is seen best in the case of persons who are in solitude. The pathetic devices of prisoners, for example, their custom of making pets of mice, flies, or anything found in their cells, and their interest in any form of activity—all these are attempts to make some symbolic substitute of activities having social value for the lack of direct social stimulus. The making of things having a social value seems to appeal to them.

Griffith, for example, says that solitary confinement is "so good an instructor that very little time is needed for teaching prisoners a trade. They go to work without squares, gravers, stamps, patterns or models. Every scrap of glass or metal, every nail and pin turns to account as a tool. Waste from the shop, bones from the kitchen, walnut, cocoanut and acorn shells," etc., serve as materials.[3] But this along with many other pathetic devices to which prisoners resort are means of saving them from the misery of solitude. This does not seem due entirely to the satisfaction of the instinct of activity, but in part to the satisfaction given symbolically to the social instincts.

The social instincts are so strong in children that if they are so unfortunate as to be largely isolated from others they are apt to create imaginary companions and to live in a dream world of society.

The aim of this paper is to present the problem. Let me for a moment, however, hint at a wider point of view.

The investigations referred to have chiefly concerned the mere presence or absence of other individuals performing similar tasks. In a true social group the relations are more vital. Each individual feels a responsibility and performs some service for the group. Here the stimulus is likely to be greater. Perhaps the greatest stimulus to mental activity from the group is social success to those who can achieve it.

Both experiment and observation have shown the great stimulus resulting from success in general. Social beings that we are, no form of success is so stimulating as a social success. When we reflect that under present conditions many of the children in our schools are so placed that a social success is impossible we see the significance of this point.

Not to mention the frequent domination of the class group by the teacher and the artificial relations often existing in our school recitations, as shown so vividly by Dr. Scott, the many defects of school children shown by modern studies in school hygiene often make social success impossible.

Among the pathetic tragedies of childhood are the cases of those who never can achieve success because of defect—the child with defective vision who can not see the blackboard, the deaf child who can not hear the teacher, the child tormented with headache or toothache, the child whose brain nutrition is reduced by nasal obstructions, the sensitive child, the misunderstood child, and the whole list of nervous defectives.

An important relation between the development and integrity of the sense organs and mental efficiency has been shown by a number of investigations. A large

[3] Small, Maurice H., "On some Psychical Relations of Society and Solitude," *Pedagogical Seminary*, April, 1900, Vol. 7, No. 1, pp. 13–69.

per cent. of those children who have defective hearing have often been found to be dullards. Also those suffering from adenoid growths are likely to be found in the class of dull children. And while myopic children are often found among those more precocious and studious in school work, this due, perhaps, to their lack of normal interest in things out of doors and muscular activities, those with eye defects often seem hopelessly dull.

It is evident that we are dealing with a problem fundamental in pedagogy and school hygiene. Every parent knows the leaden stupidity that at times comes over children, and every teacher has doubtless had experiences with at least a few cases of it in chronic form. This is the one defect which to many teachers seems hopeless. The only redeeming thing about stupidity seems to have been discovered by a German, who with rather a labored attempt at wit has said that the stupid children will make invincible soldiers, because the gods themselves fight in vain against stupidity; but what is impossible to the gods of pedagogy is sometimes possible to Hygeia. When stupidity is due to a defect of the sense organs, the difficulty can sometimes be removed by the simple device of seating the pupil in a favorable position; a surgical operation for an adenoid growth has removed the cause of stupidity in the case of many children; and frequently what the stupid child specially needs is enough to eat, or sufficient sleep, or rest from work imposed out of school hours, or perhaps the mere stimulus of social success. In any case the cause should be sought.

Thus the simple problem with which we started leads out into the wider problems of social hygiene and social pedagogy; and here I must leave it with the hope that it will be considered by teachers and studied further by investigators.

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*THE PRINCIPLE OF RELATIVITY*

AT the recent Boston meeting of the American Physical Society there was so much general interest in the principle of relativity and so many questions were asked me personally by those who had given the subject very little attention, that it seems timely to give a brief introduction to the subject on a somewhat simpler basis than I think has yet been attempted. The method employs several of the "non-mathematical" conceptions first introduced by Lewis and Tolman, but I think the demonstrations will be found even simpler than theirs.

The principle of relativity is one attempt, and by far the most successful attempt as yet, to explain the failure of all experiments designed to detect the earth's motion through space, by its effect on terrestrial phenomena. It generalizes this universal negative result into its first postulate, which is, *the uniform translatory motion of any system can not be detected by an observer traveling with the system and making observations on it alone.*

The second postulate is that *the velocity of light is independent of the relative velocity of the source of light and observer.*

At the very outset, it is important to realize that we have no long-standing experience with systems moving with velocities comparable with that of light, and therefore that primitive intuition may not be the very best guide in first introducing us to them. We might easily imagine a peasant scorning the suggestion that the dimensions of a rigid body changed with the temperature, and declaring, on being